Document Number 110

Entry 145 of 244 File: USPT Dec 1, 1987

DOCUMENT-IDENTIFIER: US 4710400 A
TITLE: Chemical process for conferring conductor, antistatic and flame-proofing properties to porous materials

BSPR:
The solid and impregnable material, useful to the purposes of the present invention, can be a porous and/or absorbent solid material, such as paper or cellulosic materials in general, cotton cloth, woollen fabrics or synthetic fabrics in general, and porous ceramic. Still further solid and microporous materials, in form of thin films, of plastic or elastomeric materials, such as polyethylene, polypropylene, and natural and synthetic rubber are useful to the purpose. Also wood in the form of thin sheets can be used.

DEPR:
On a polyethylene sheet, of 0.1 mm in thickness, pyrrole is spread on one face. The other face is dipped into an aqueous solution at 30% by weight of FeCl.sub.3.6H.sub.2 O, and the container is kept closed for 12 hours. Pyrrole runs slowly through the micropores of the sheet and polymerizes on coming into contact with the oxidizer solution, coating by a conductive pyrrole polymer the dipped face only.

DEPR:
The sheet, washed with water and acetone, and dried at room temperature, has a conductivity of about 7 .OMEGA..sup.-1.cm.sup.-1. The electrical resistance between two points increases if the sheet is stretched.

CLPR:
3. The process of claim 2 wherein the microporous material is selected from polyethylene, polypropylene, natural rubber and synthetic rubber.

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Document Number 12

Entry 57 of 244 File: USPT Apr 8, 1997

DOCUMENT-IDENTIFIER: US 5618642 A
TITLE: Battery separator with sodium sulfate

BSPR:
Various microporous membranes or sheet materials have been suggested for utilization as a battery separator. Separators conventionally used in present battery systems are formed of polymeric films which when placed in an electrolyte or an electrolyte system, are capable of exhibiting a high degree of conductivity while being stable to the environment presented by the battery system. The films include macroporous as well as microporous materials. The porosity permits transportation of the electrolyte. Examples of such separators include polyolefin sheets which have been stretched and annealed to provide microporosity to the sheet, such as is described in U.S. Pat. Nos. 3,558,764, 3,679,538 and 3,853,601. U.S. Pat. No. 3,351,495 to Larsen et al. discloses a battery separator having a relatively low pore size and satisfactory electrical resistance characteristics made from a high molecular weight polyolefin having an average molecular weight of at least 300,000, a standard load melt index of substantially zero, and a reduced viscosity of not less than 4. The separator is manufactured by extruding the high molecular weight polyolefin in admixture with an inert filler and a plasticizer and then extracting the plasticizer by the use of a suitable solvent. Other conventional separators for lead-acid and gas recombination batteries contain mostly glass fibers, and in particular, asbestos glass fibers. In view of the recent scrutiny to which asbestos has been subjected, it would be desirable to provide a non-asbestos containing battery separator that exhibits the same or better characteristics than the conventional asbestos-containing separators. Moreover, polymer separators have higher tensile strength than glass mat separators and thus are more conducive to high speed manufacturing, which can significantly reduce production costs.

BSPR:

The polymer that may be used to form the battery separator should be stable with respect to the battery environment in which the separator will be used. Representative examples include polyolefins, halogenated polyolefins, polyamines, polyurethanes, polyethylene imines, polyvinyl chloride, cellulosic materials as well as their copolymers and mixtures thereof. Polyolefins are preferred, with representative polyolefins being polyethylene, high density polyethylene, polypropylene, polybutene, ethylene-propylene copolymers, ethylene-butene copolymers, propylene-butene copolymers, ethylene-propylene-butene copolymers, and an ultra high molecular weight polymer (UHMW) having an weight average molecular weight of at least about three million, preferably at least about four million, as determined according to ASTM D-4020 or DIN-53493 or by the Zero Tensile Strength Test (ZST) as having a value of at least 0.1, preferalby 0.1 to 1 (Newtons/mm.sup.2), more preferalby between 0.2 and 0.6 N/mm.sup.2. The preferred polyolefin is UHMW polyethylene or UHMW polypropylene.

BSPR:
One suitable battery separator for use in the present invention is that disclosed in U.S. Pat. No. 3,351,495, the disclosure of which is hereby incorporated by reference. That separator comprises a microporous sheet of polyolefin having a molecular weight of at least 300,000, a standard load melt index of substantially 0 and a reduced viscosity of not less than 4.0. Preferably the battery separator comprises a homogenous mixture of 8 to 93 volume percent of very high molecular weight polyolefin, 0 to 15 volume percent of a plasticizer, and 7 to 92 volume percent filler, including silica. The separator is produced by blending the high molecular weight polyolefin, the inert filler material and the plasticizer, forming the composition into sheet form, and subsequently extracting from the sheet by means of a suitable solvent a portion of the inert filler and plasticizer.

BSPR:
The preferred formulation for a battery separator membrane consisting of 65% processing oil, 10% UHMW polyethylene and 20% precipitated silica filler which includes a minimum of 2.8 weight percent sodium sulfate.

DEPR:
8.6 pounds of UHMW polyethylene, 34.6 pounds processing oil, 23.8 pounds of silica containing 10 weight percent of sodium sulfate, and 2 pounds of minor ingredients (antioxidant, carbon black pellets, etc.) are blended in a high shear mixer. The resulting dryblend is transferred to a hopper for extrusion. Additional processing oil is added at the feed throat of the extruder so that the total oil content of the extruded black sheet is approximately 63%. The oil in the sheet

is extracted with a solvent (hexane) to achieve a porosity of 60% for the finished separator product.

CLPR:
1. A battery separator comprising a microporous layer formed of a blend of polyolefin, silica and a processing aid, said silica having a sodium sulfate content of about 7-13 %.

CLPR:
2. The battery separator of claim 1 wherein said polyolefin is polyethylene or polypropylene.

CLPR:
7. A battery comprising a housing, an electrolyte, a series of positive plates and negative plates, and a microporous battery separator around either the positive or negative plates, said battery separator comprising a microporous layer formed of a blend of polyolefin, silica and a processing aid, said silica having a sodium sulfate content of about 7-13 %.

CLPR:
10. The battery of claim 7, wherein said polyolefin is polyethylene or polypropylene.

CLPV:
b. blending a polyolefin with said precipitated silica having said sodium sulfate content and a processing aid;

CLPV:
d. blending a polyolefin with said silica having said sodium sulfate content of 10-11% and a processing aid;